

# R&D

# NOW

THE MAGAZINE OF CURTIN'S OFFICE OF RESEARCH



Curtin University

SUMMER 2015/16

## Rewriting the geology textbook

**Professor Zheng-Xiang Li's**  
*How the Earth Works* will  
lead to a tectonic shift on  
our understanding of the  
planet's evolution.

**Innovation to the nth degree**  
Cisco builds a connected  
community at Curtin.

**A new high-water mark**  
Spatial scientists use GIS to  
better manage Bangladesh's  
flood response.

**Low carbon living lab**  
New housing development  
tackles the big issues of  
sustainability and affordability.



# CURTIN'S RESEARCH STRATEGY

**Curtin is committed to achieving its vision for 2030: to be a recognised international leader in research and education.**

## Curtin will:

- strengthen as a research-intensive university
- attract and retain iconic scholars to undertake world-leading research in areas of global significance
- change lives in Western Australia, the nation and the world through high-impact research.

Curtin's status as a research-intensive university will be determined by the quality, scale and significance of its research, as assessed against national and international benchmarks.

The University will focus its resources to invest in areas of high-quality research and creative production that truly matter, generating outputs that have relevant and significant impact on communities. It will lead through the discovery and practical application of knowledge that addresses real-world issues and changes lives. It will excel in thought-leadership through creative expression and through our influence on public debates, changing the minds of decision-makers at all levels on issues that matter to society.

By increasing our investment in areas of strategic significance, Curtin will be home to a growing number of world-class researchers who will deliver research of greater global impact than ever before.

<b>PARTNERSHIPS</b>	
What you know and who you know	2
<b>CONSERVATION BIOLOGY</b>	
Broome and beyond: conserving Broome's backyard botanical wonderland	4
<b>COMPUTATION</b>	
Innovation to the nth degree	5
<b>SUSTAINABLE DEVELOPMENT</b>	
Low carbon living laboratory	6
<b>PROFILE</b>	
Doctor Vanessa Rauland	7
<b>SUSTAINABLE COMMUNITIES</b>	
The best laid plans... environmental activism and the desire to 'live local'.	8
<b>HEALTH SCIENCES</b>	
Medical school to boost research capability	9
<b>PROFILE</b>	
Professor Andrew Putnis	10
<b>GEOSCIENCE</b>	
Rewriting the geology textbook	10
<b>PUBLIC HEALTH</b>	
Heatwaves on healthcare: The formula for early diagnosis	12
<b>ECONOMICS</b>	
China not the 'be all and end all' for Aussie trade	13
<b>SPATIAL SCIENCE</b>	
A new high-water mark in flood relief	14
<b>MARINE ECOLOGY</b>	
Quiet up there!	15
<b>COMMERCIALISATION</b>	
Innovations 2015	16
<b>HIGHER DEGREES BY RESEARCH</b>	
Graduate studies overview	18
Graduate profiles	18
<b>ASTRONOMY</b>	
Q+A: Doctor Thomas Russell	20

## OUR AREAS OF STRENGTH

### MINERALS AND ENERGY

### ICT AND EMERGING TECHNOLOGIES

### SUSTAINABLE DEVELOPMENT

### HEALTH

# R&D 2015 OVERVIEW

**There's a lot to celebrate after a highly productive and successful year of research at Curtin.**

**Professor Graeme Wright**



**A major achievement was the announcement of Curtin's 271st ranking in the Academic Ranking of World Universities (ARWU), up from 303 in 2014. The state-of-the-art Cisco Internet of Everything Innovation Centre became the latest addition to a growing stable of computation-focused research centres at the University (see page 5). We also launched the Curtin Institute for Computation, a new institute to focus on our broad base of computational and data scientists. Curtin has been a major player in the development of Australia's computational capability for some time, largely due to the data processing demands of our radio astronomy research and computational chemists.**

Given our existing expertise in astronomy, we were delighted to sign an affiliate agreement with NASA's Solar System Exploration Research Virtual Institute (SSERVI) in July. The partnership, led by Curtin, will foster collaboration with NASA and other Australian universities as NASA embarks on a new era of space exploration. I appreciate the leadership of Australian Laureate Professor Phil Bland from the Department of Applied Geology for facilitating this partnership.

Finally on the astronomy front, Co-Director of the Curtin Institute of Radio Astronomy (CIRA) Professor Steven Tingay has been selected as the founding director of l'Osservatorio di Radioastronomia (Radio Astronomy Observatory) for the Italian National Institute of Astrophysics on a three-year tenure. Whilst maintaining his deep links with Curtin, Professor Tingay will lead Italy's contribution to the landmark billion-dollar Square Kilometre Array (SKA) project, to be constructed in Western Australia and South Africa. I wish Professor Tingay *"buona fortuna ma non addio"* (good luck but not goodbye).

Another of Curtin's most celebrated researchers, Professor Zheng-Xiang Li from the Department of Applied Geology, was again acknowledged as one of the world's leading geoscience researchers in June, receiving a \$2.9 million Australian Laureate Fellowship from the Australian Research Council (ARC). Congratulations Professor Li. You can read more about Professor Li's research on page 10.

Curtin's Research Week, from 31 August – 4 September, was a way to showcase the University's innovation, research strengths, capabilities and achievements. The week began with a captivating public lecture on the Two Lost Ships project, detailing the work of Curtin researchers to digitally reconstruct the wrecks of the Australian *HMAS Sydney II* and German *HSK Kormoran*.

A range of other events were held during the week to showcase Curtin's wonderful research, including the Three Minute Thesis Curtin Finals, where PhD students vied for a place in

the Trans-Tasman final held at The University of Queensland. Congratulations to Adnan Mannan, who was crowned the Curtin winner (see Graduate Profiles on page 18 for more about Adnan's research). The week ended with the presentation of the Curtin Research Awards for Excellence. Congratulations to the winners:

- **John de Laeter Award for Research Leadership** – John Curtin Distinguished Professor Chun-Zhu Li
- **Paul G Dunn Research Development Award** – Professor Keith Hill
- **Curtin Research Impact and Engagement Award** – Lakhnu Sustainable Rural Development Project Team
- **Curtin Research Support Award** – Dr Rebecca Anderson

I would also like to thank Deanne Barrett and the Research Week Committee for making Research Week 2015 a great success.

Later in September, Curtin's Commercial Innovation Awards attracted a record 46 innovators from across the University. Congratulations to the winning team, whose 3D-printable Assisted Finger Orthosis took first prize of \$15,000 and valuable commercialisation assistance.

The team, which included mechatronics lecturer Dr Lei Cui and students Anthony Phan and Otto Seyfarth, drew on expertise from across the University, collaborating with researchers in the fields of engineering, occupational therapy and the humanities. It's inspiring to see such an outcome from a genuine cross-disciplinary team. See *Innovations 2015* on page 16 for more on this year's awards.

Also in this issue, we speak to Professor Peter Newman from the Curtin University Sustainability Policy Institute about a four-year project to evaluate the sustainability and community acceptance of the eco-friendly White Gum Valley development in Fremantle on page 6. Dr Thor Kerr's research on page 8, is also in the broad field of sustainable development, but focuses on environmental activism and the desire to live 'a local existence'.

From local to global, we cover some of Curtin's biggest partnerships with industry on page 2. These partnerships are mutually beneficial, providing our researchers with real-world data and networks, and providing industry with a broad range of expertise and innovative solutions.

I wish you a happy holiday season and look forward to consolidating the success of 2015 in 2016.

**Professor Graeme Wright**  
Deputy Vice-Chancellor, Research



# What you know and who you know

Story by Kitty Drok

**To solve global problems, researchers need to be part of a global network. In recent years, Curtin has been working together with some of the world's biggest industry players, with the benefits flowing both ways.**

**C**urtin is forging important partnerships with some of the world's largest companies. It's a natural progression from years of industry involvement through a variety of endeavours, including the Cooperative Research Centre Program, the Sustainable Built Environment National Research Centre and the Centre for Crop and Disease Management.

Global partnerships between universities and industry are essential at a time when researchers are seeking to address increasingly global problems such as energy security and sustainability. For universities, it's about diversity of research effort, access to industry problems and data, a focus on relevance and application, and outcomes with economic and community benefits. For industry, partnering with universities offers access to a broad range of expertise, specialised facilities and multidisciplinary research networks.

As collaborations become more substantial, the outcome is often less about solving a specific problem, and more about developing infrastructure, expertise and research capacity to support entire industry sectors well into the future.

### Cisco

Cisco, with foundation partners Curtin and Woodside, launched the Internet of Everything Innovation Centre at Curtin in July. It aims to catalyse innovation and development, bringing together start-ups, industry experts, developers, customers, government organisations and researchers in an open environment. It will create a 'connected community' focused on cloud, analytics, cybersecurity and Internet of Everything network platforms.

The centre provides co-working space, a demonstration area and laboratory facility, and facilitates research and technology demonstration projects with an initial focus on resources and mining, astronomy and big data. See Innovation to the nth degree on page 5 for more.

### Woodside

The Curtin-Woodside Chair in Oil, Gas and LNG Construction and Project Management aims to develop best practice for the LNG industry to improve productivity and safety.

Woodside is also collaborating with Curtin's Australasian Joint Research Centre for Building Information Modelling to improve the productivity and performance of its major construction projects. Project Echo created a virtual assembly tool that locates users in a physical space and overlays a 3D model of the design, with assembly instructions, parts specifications, inspection requirements and logistics information. The time and budget overruns can be significantly reduced using this fully integrated system.

### Chevron

Curtin and Chevron's Energy Research Partnership aims to enhance knowledge and capability in soft rock and petroleum geology. It encompasses a Chair in Petroleum Geology, with projects looking at oil and gas systems with the intent of reducing cost, increasing certainty of production and increasing reserves.

Activities extend well beyond exploration and extraction, and encompass environmental concerns. Research in the Centre for Marine Science and Technology involves several projects that study the marine soundscape to evaluate the impact of noise on the local marine environment.

### Curtin Corrosion Engineering Industry Centre

The Curtin Corrosion Engineering Industry Centre has been conducting research and providing consultancy services to the oil and gas industry for more than two decades, leading to substantial maintenance costs savings for the partners.

Industry sponsorship established the Chevron-Woodside Chair in Corrosion Engineering, to develop new and larger projects. Recent developments include the construction of a monoethylene glycol plant, allowing bench-scale studies on inhibiting corrosion inside oil and gas pipelines.



# BROOME AND BEYOND:

## CONSERVING BROOME'S BACKYARD BOTANICAL WONDERLAND

Story by Karen Green

**"The Kimberley is one of the last great botanical frontiers, with more new species being discovered than anywhere else on Earth."**

Professor Kingsley Dixon surely is the world's crusader for the botany of Western Australia's Kimberley. For more than 40 years Dixon has been undertaking field trips during the region's wet season, discovering new plant species and cataloguing tropical flora.

Dixon joined Curtin's Department of Environment and Agriculture in 2015, considerably extending the University's capability in Australian plant sciences. His particular interests are the conservation of rare and threatened indigenous flora, and ecological restoration of degraded landscapes. Through Dixon's partnerships with leading botanical research organisations, the Royal Botanic Gardens, Kew (UK) and the Missouri Botanical Garden (US), Curtin is able to access one of the best knowledge networks in tropical botany.

Shortly after taking up his professorship, Dixon established the 'Broome and Beyond' research program, which has had early success with the discovery of a new species of blue waterlily.

"The Kimberley's biodiversity has been misunderstood and overlooked. Only now is the flora being recognised as internationally significant," Dixon says.

"During the wet season the Kimberley is a botanical wonderland of orchids and waterlilies, and the ephemeral pools are among the most unique rock pools on the planet."

As such, Dixon expects that discoveries of the region's rock pool flora will lead to a new horticultural industry in indigenous Kimberley plants and food plants for the region. Perhaps more importantly, the outcomes of the Broome and Beyond program will help conserve the Kimberley's flora from several introduced threats.

"Overgrazing is a problem, as are feral animals such as donkeys, and the spread of exotic weeds," he explains.

"The high frequency of burning is also harmful to the unique vegetation of the Broome peninsula, where some species take up to 15 years to mature."

Accordingly, he expects the Broome and Beyond research to not only facilitate new studies in indigenous tropical botany and offer new opportunities in horticulture, but also to inform better fire management regimes.

In addition, Dixon's research interest in restoring degraded landscapes have led him to initiate a new International Network for Seed-based Restoration. To be launched in Washington in 2016, the network will bring together scientists, industry, NGO organisations and governments to advance seed ecology and restoration technologies. Importantly, the initiative will facilitate seed-based restoration of landscapes worldwide, as well as focus world attention on Curtin's emerging restoration ecological capabilities.

[curtin.edu.au/Kingsley.Dixon](http://curtin.edu.au/Kingsley.Dixon)



# INNOVATION TO THE NTH DEGREE

Home-grown innovation is set to flourish at Curtin through a networked community of researchers, industry partners, start-up companies, application developers and government organisations. Story by Karen Green

Only a decade after hailing the 'Internet of Things' (IoT), the world of research and development is welcoming the 'Internet of Everything' (IoE). While the IoT comprises a digitally connected network of physical objects, it is only one of many technology transitions that enable the IoE's system of objects, data, people and process.

The immense capability of the IoE is now recognised as a gold mine of innovation. Fittingly, leading global IT company Cisco has chosen to establish its eighth global Cisco Internet of Everything Innovation Centre (CIIC) at Curtin, where it will draw on the expertise within the Curtin Institute for Computation.

The Institute's Director, Professor Andrew Rohl, expects the CIIC will enable promising innovators to transform the realm of raw data and accelerate the pace of human endeavour.

"Network connections create an overwhelming volume of data," Rohl explains. "The path to innovation is the ability to exploit the data."

"The Internet of Everything exploits cloud or supercomputing power for big-data processing and the development of smart applications that use the data."

"For example, sensors are commonly used in the maintenance regime of processing plants. They're inexpensive and easy to install, so there's no problem in the ability to detect issues as they're occurring. The aim is to predict when the problem will occur – and the solution will almost always be found in the real-time processing of the data."

The CIIC represents a \$30 million initiative from Cisco and foundation partners Curtin and Woodside Energy, that brings together industry clients, researchers and developers to discuss industry problems and brainstorm solutions.

The centre provides collaboration spaces, a project demonstration area and a lab facility where researchers can experiment with the latest cloud, analytics, cyber-security and network platforms.

For Curtin, the capabilities will further progress the University's research that is pushing the boundaries of scientific knowledge in areas such as radio astronomy, agriculture and engineering.

For example, Professor Xiangyu Wang, from Curtin's Department of Construction Management, is working with Woodside on building information modelling for oil and gas facilities. Using sensors and data analytics, the research team has been assessing the traffic zones on offshore

platforms as a precursor to safety improvements.

The work has contributed to Woodside's 'Plant of the Future' strategy, which links process plant design with artificial intelligence, data analytics and advanced sensors and control systems to develop environmentally safer and more efficient operations.

Importantly, the CIIC welcomes small business and start-up companies that require support with R&D, prototyping and commercialisation of new technologies. It is this feature, Rohl believes, that will position the CIIC and Western Australia as global contributors in the development of technologies exploiting big data to deliver scientific and societal innovations.

"Data analytics is a part of the toolkit every researcher should be using," Rohl says. "It can be used to advance everything from gas pipelines to population health."

The CIIC was launched in July 2015 by WA Premier Colin Barnett, Curtin Vice-Chancellor Professor Deborah Terry, CEO of Woodside Energy Peter Coleman, and Senior Vice-President Cisco Asia Pacific and Japan, Irving Tan.



**W**hite Gum Valley in the City of Fremantle is hosting a 2.2 hectare medium density residential infill development that will eventually be home to around 150 people. Led by LandCorp, the development is the focus of a CRC for Low Carbon Living project led by Professor Peter Newman and Josh Byrne from the Curtin University Sustainability Policy Institute.

The development features a range of building types, from 3-4 storey apartments and townhouses to single home sites, and includes a Gen Y demonstration housing project and artists' collective.

More importantly, the precinct-scale design features climate-responsive considerations, creative urban greening, and energy and water saving strategies.

"Each roof is covered in solar photovoltaics, and the development will be trialling a community-based energy system, complete with batteries for energy storage," explains Newman.

"Rainwater will be harvested for household use and stormwater will be directed to an area containing a community bore – effectively allowing stormwater to recycle back to the gardens."

In addition to their involvement in the design of the development, Newman and Byrne will be following it from construction (now underway) to completion and through to occupancy.

Similar to 'Josh's House' ([joshshouse.com.au](http://joshshouse.com.au)), the development will have an integrated monitoring system, logging local weather conditions, building temperatures, water usage (mains, rainwater and bore), gas usage and electricity supply (rooftop photovoltaics and grid).

"The literature is full of zero-carbon house designs, but they're usually not monitored after they're built," says Newman.

"Josh's House is being monitored as he lives in it, it's providing real-time data on its eco-efficiency. In White Gum Valley we are extending monitoring to a whole subdivision, and will eventually have hard data to demonstrate how much people can save on their lifestyles."

"We will also be measuring community acceptance – what features people like, why they want to live there, how important the sustainability features are to their lifestyle choices," says Newman.

"So far the locals love the project, even though the development is substantially denser than anything in their area. It's a model for mainstream middle-suburbs redevelopment in Perth: low water, low carbon, low cost, but high amenity with a real sense of community."

[lowcarbonlivingcrc.com.au/research](http://lowcarbonlivingcrc.com.au/research)

# LOW CARBON LIVING LABORATORY

Story by Kitty Drok

**A new 'living laboratory' project is attempting to address the problems of a growing population, competition for water supply, sustainable power generation, housing affordability and social alienation all in one hit.**



**Dr Vanessa Rauland**

Research and Graduate Studies  
Faculty of Humanities

**A**t the Curtin University Sustainability Policy Institute (CUSP), Dr Vanessa Rauland completed her PhD in what is arguably the most relevant research area in society and environment.

Supported by an Australian Research Council grant, her research analysed how urban cities can be 'decarbonised' through revolutionary approaches that incentivise low-carbon development. The outcomes have now contributed to a book, *Decarbonising Cities: Mainstreaming Low Carbon Urban Development*, which she co-authored with world-leading sustainability researcher, Professor Peter Newman.

From global to local, Rauland and her CUSP colleague Dr Samantha Hall have been assisting schools, not-for-profits and other businesses and organisations to implement low-cost solutions for managing their carbon footprint.

Three years ago the pair established a company, SimplyCarbon, after assisting South Fremantle Senior High School to become Australia's first certified carbon-neutral school. The achievement drew extensive community interest, and SimplyCarbon has now developed an innovative program to assist more schools in reducing their carbon emissions and operating costs.

Rauland and Hall's latest research also includes the development of an interactive online tool that enables people to evaluate their workspace according to physical and social environment factors such as light, temperature, greenery, movement, and the ability to interact person-to-person with colleagues. The outcomes will help develop benchmarks and comparisons for commercial office fit-outs, to improve personal wellbeing in the work environment. Testament to the creative vision of the project, 'Rate my Space' won the Business School Prize of the 2015 Curtin Commercial Innovation Awards (see *Innovations 2015*, page 16).

In addition, she supervises 10 PhD students who are undertaking research in the area of renewable energy and low-carbon cities.

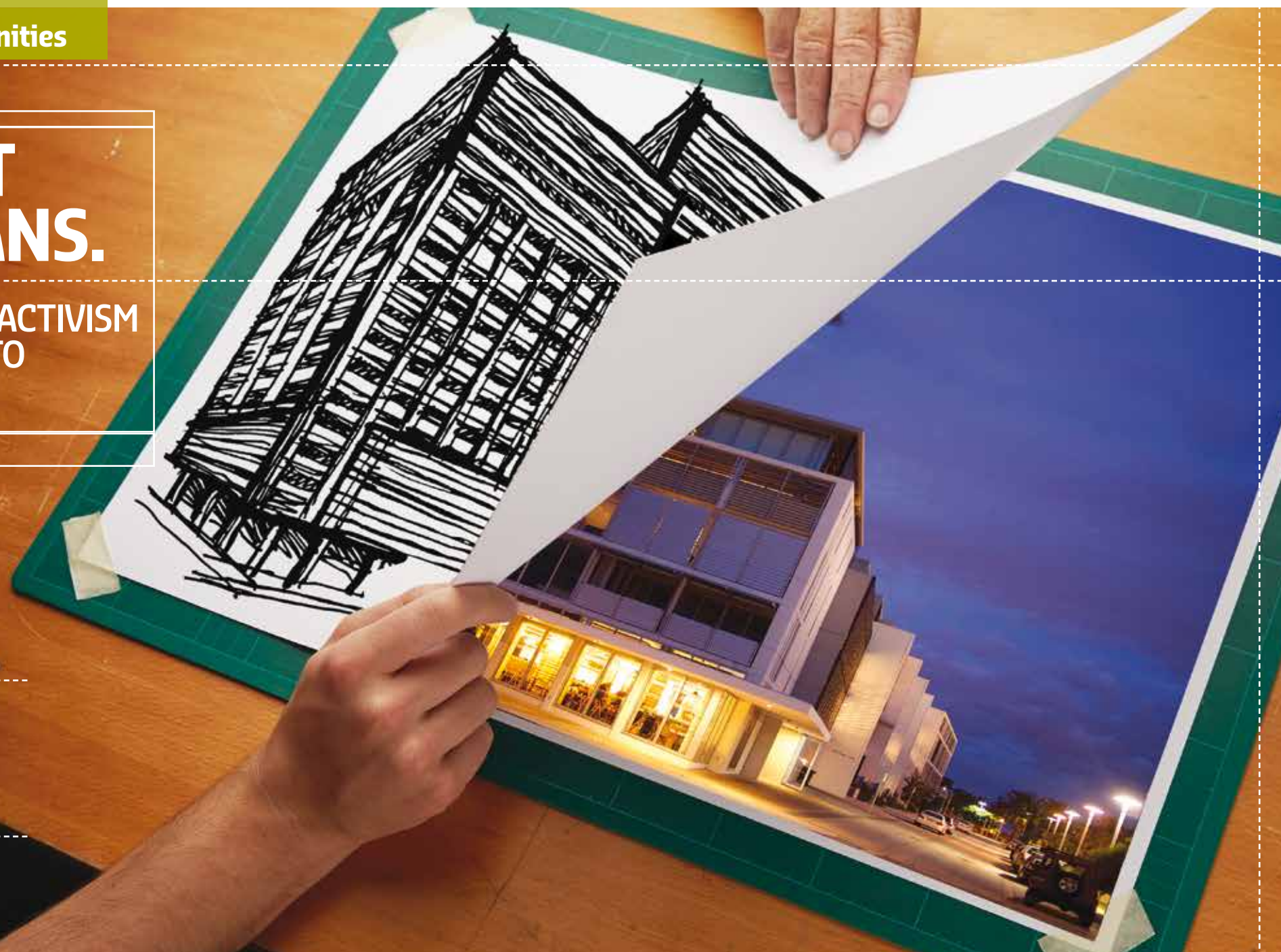
[humanities.curtin.edu.au/V.Rauland](http://humanities.curtin.edu.au/V.Rauland)



# THE BEST LAID PLANS.

ENVIRONMENTAL ACTIVISM  
AND THE DESIRE TO  
'LIVE LOCAL'.

Story by Karen Green



**At Curtin's School of Media, Culture and Creative Arts, Thor Kerr is studying the political discourse around 21st century built environments. He is particularly interested in community resistance to clean-and-green credentials claimed by property developers.**

In his new book, *To The Beach* (UWAP, 2015) Kerr reveals how local communities are shunning propaganda for 'sustainable' developments that may in fact be environmentally risky.

"Property developers use catchphrases to elicit public support and government approvals. But people are starting to question the meaning of 'green building', and the measures used when a developer claims a project is an 'ecological improvement'," Kerr says.

To encourage critical analysis of environmental discourses, Kerr's book focuses on a 2009 proposal for the construction of several small artificial islands near Fremantle in Western Australia. Known as North Port Quay, the proposal outlined a multi-billion-dollar offshore residential and commercial community with education and cultural amenities.

"The developer needed a good reason for reclaiming the seabed off Port Beach, and so presented a plan for an environmentally friendly and carbon-free community that would apparently set an international benchmark for sustainable development," Kerr says.

"However, the local community viewed the development as a radical imposition on the coast, which triggered a community movement and a media counter-campaign to preserve the legitimate, sensual experiences of their environment."

Kerr's recent paper in the journal, *Continuum: Journal of Media & Cultural Studies*, explores the phenomenon of how environmental activism forms around a shared desire to live a local experience.

"North Port Quay's failure with the community demonstrates the discursive struggle over the space and time of environmental problems," he says.

"Despite being marketed as potentially world-leading in sustainable development, it offered the immediate community no solutions to the local, immediate environmental threats inscribed in it.

"Representations of an immediate threat to local environment can be more powerful than representations of a model solution to future global ecological crises."

Kerr's research is wide-ranging, covering social and environmental issues. As a member of the Australia-Asia-Pacific Institute at Curtin, he is also studying rapid changes in the trade, demographics, cultures and environments of the Indian Ocean rim.

He recently attended the Ubud Writers & Readers Festival in Indonesia, joining panels discussing property reclamation projects and environmental threats. The festival also presented an opportunity to discuss his new book, co-edited with Professor John Stephens, *Indian Ocean Futures: Communities, Sustainability and Security*.

[humanities.curtin.edu.au/Thor.Kerr](http://humanities.curtin.edu.au/Thor.Kerr)



## MEDICAL SCHOOL TO BOOST RESEARCH CAPABILITY

Story by Kitty Drok

**Curtin Medical School's five-year undergraduate degree will address a doctor shortage in WA, but the school will also provide an important boost to health research at Curtin.**

Curtin's new medical school has been approved by Federal Government to open its doors to students in 2017. Its five-year direct-entry degree will have a strong emphasis on primary care, positioning graduates well for rural and remote practice. Pro Vice-Chancellor of Health Sciences Professor Michael Berndt, explains, "We will be focused on training generalists, rather than specialists. We want to create highly competent doctors who can integrate with other professionals, and put quality care first."

This focus will also be reflected in the school's developing research strengths. "Staff recruitment for the medical school will have less emphasis on clinical specialists in the 'ologies' – cardiology, gastroenterology, neurology and the like – but will attract professionals with interests in rural health, Indigenous health, health services issues, point-of-care diagnostics, telemedicine and e-health. Medicine at the more translational end with the community," says Berndt.

There will be overlap with the School of Public Health, which already has significant research activity in areas such as health promotion and epidemiology.

"It is an obvious fit," states Berndt, "and the medical school will eventually strengthen research activities right across the health sciences. The faculty has strengths in translational research related to the clinical therapies: psychology, nursing, all the allied health areas. Having a medical school will make it much easier for these researchers to involve medical clinicians in their research teams, adding the element of clinical expertise to their research capacity."

Medical schools are entrenched in two worlds, being part of the university while also closely interacting with the hospital system. As the new school develops relationships with hospital-associated clinicians through sessional teaching, tutoring and student clinical placement, the opportunities for patient access will steadily increase. Berndt anticipates that research activity in the clinical trials area will eventually become a major focus.

"Most Curtin researchers involved in clinical trials are using the general practice network at the moment, but through the medical school, we will be able to address a much broader range of clinical issues by trial. All sorts of interventions can be studied in a more holistic manner, which will broaden the scope for all health researchers at Curtin."



## Professor Andrew Putnis

Director of The Institute for Geoscience Research (TIGeR)  
Faculty of Science and Engineering

**P**rofessor Andrew Putnis joined Curtin in February 2015 as the Director of The Institute for Geoscience Research (TIGeR).

TIGeR brings together key members of the Departments of Applied Geology and Exploration Geophysics, the John de Laeter Centre for Mass Spectrometry, the Western Australian Centre for Geodesy, and the WA-Organic and Isotope Geochemistry Centre. But Professor Putnis also intends TIGeR to support any activity interacting with the geosciences area, from the business school to health sciences.

As Director, his aim is to improve Curtin's visibility as the premier geoscience institute in Australia: the first choice for international experts to visit, and Australia's hub for industrial and research collaboration in the geosciences.

He recently initiated an annual TIGeR conference, with the inaugural three-day event hosting an impressive line-up of international speakers at Curtin in September. With an emphasis on relatively short presentations and long discussions, it provided a venue for lively debate between subject experts, and great opportunities for strengthening research networks.

Keeping Curtin geosciences in the centre of national research networks, Professor Putnis has already been involved in two new Centre of Excellence proposals in the areas of critical metals and mineral resources, and a number of ARC Discovery grant applications.

Professor Putnis' research interests span the breadth of fluid-mineral interactions: from nanoscale studies of the mechanisms controlling mineral dissolution and precipitation, to macro-scale insights about rock metamorphism and ore deposition.

Professor Putnis gained his bachelor degree in NSW from the University of Newcastle (physics), before moving to the UK and completing a second bachelor degree at the University of London (geology), followed by a PhD from the University of Cambridge.

After 14 years as Lecturer in Earth Sciences at the University of Cambridge, he then spent 20 years as Professor of Mineralogy at the University of Münster, Germany, before returning to Australia.

[tiger.curtin.edu.au](http://tiger.curtin.edu.au)

**L**ike the centre of an earthquake, Professor Li's research ripples have been felt widely, with his recognition as a Thomson Reuters Highly Cited Researcher in 2014. The ripples will now propagate further, with Professor Li awarded a five-year, \$2.9 million Australian Laureate Fellowship from the Federal Government in June – one of only 15 awarded nationally. This will support his Fellowship project, 'How the Earth Works' towards building a new tectonic paradigm.

"Plate tectonic theory was developed in the 1960s, and gave us a dynamic view of the Earth's surface – with plates colliding to form mountain ranges, and drifting apart to widen oceans. It explains what we see on the surface," says Professor Li, "but it doesn't explain why. What forces drive the plate movements? How does the Earth 'engine' really work? Answering these questions is fundamental to understanding this planet, reconstructing its history, and predicting its future."

Progressing our understanding of the dynamic Earth has only become possible over the last 10–20 years, with the development of several new technologies. Seismic tomography now allows us to see the deeper internal structure of the Earth's mantle, and can track the movements of ocean plates pushed down under the crust, as well as the upward motion of hot rocks in the mantle.

Rapidly expanding databases of palaeomagnetic and geological information have extended our understanding of supercontinent history from just the last 540 million years to 1,000 million years ago and beyond: before Gondwanaland and Pangea to the previous supercontinent Rodinia, with glimpses even further back.

Advances in supercomputing tie it all together: reconstructing the seismic data, collating the databases, and allowing the development of sophisticated models to simulate geodynamic processes. Researchers can now simulate plate tectonic and deep mantle processes occurring over hundreds of millions of years.

"We are starting to realise that the Earth's history has been dominated by supercontinent cycles, where the land masses come together, then break up again," explains Professor Li.

"Our current hypothesis links supercontinent evolution with superplume events in the mantle, and this fellowship project will collect and combine paleomagnetic and geological data worldwide to test and refine our model. We aim to revolutionise understanding of the inner workings of the dynamic Earth, and thereby extend our knowledge of the Earth's history back 2,000 million years."

Along the way, the international collaborative effort will establish global geological, geotectonic, paleomagnetic, and mineral deposit databases, and new tools to collate and organise the data. These will be made freely available to researchers and industry, with widespread application to resource exploration, fossil and evolution studies, and climate modelling.

[geology.curtin.edu.au](http://geology.curtin.edu.au)

# REWRITING THE GEOLOGY TEXTBOOK

Understanding the evolution of our planet requires a research team that spans the globe, but Professor Zheng-Xiang Li, from Curtin's Department of Applied Geology, is at its epicentre.

Story by Kitty Drok





### A Curtin researcher is trialling predictive formulas to help health services prepare for increased demand brought about by heatwaves.

**H**eatwaves have caused more deaths in Australia over the past 200 years than any other natural hazard. Climate change is likely to worsen the outlook, with the number of heatwave-related deaths expected to double over the next 40 years, as heatwaves increase in frequency and intensity.

There is an established link between the demands on health services and higher temperatures. Many health authorities have emergency heat management plans to prepare for the increased demand on services when temperatures rise. Preparing appropriately requires a formula to predict when a heatwave will occur and ideally, give a measure of its severity, which is difficult without a standard global definition for a heatwave.

Dr Le Jian, from Curtin's School of Public Health, and the Public Health Division of the Department of Health, has been working with a joint research team and the Bureau of Meteorology to determine which of several heatwave formulas have the greatest predictive power for additional health service demand.

"We found that a formula recently developed by the bureau to predict a heatwave, could also be used to predict the demand on health services," says Le.

The Excess Heat Factor (EHF) formula quantifies the intensity of a heatwave by comparing the average daily temperature forecast for the next three days against historical values for the same location, but importantly then contrasts it against the 30 days just prior. The comparison against the previous 30 days is critical, and may account for the formula's success in predicting health services demand.

"Accounting for acclimatisation makes sense, when you consider human physiological responses to heat," explains Le. "These adaptations include changes in heart rate, plasma volume, sweating rate and core temperature, but they occur gradually with heat exposure."

The formulas were tested by comparing their assessments of heatwave severity over a seven-year period using Perth weather data against the subsequent number of presentations to emergency departments (ED) from all causes, and the number of hospitalisations from heat-related causes within the Perth metropolitan region.

"We are now testing the usefulness of EHF as a predictive measure at different geographical locations. EHF references local historical trends, rather

than arbitrary threshold values: one advantage of using a comparative measure is that it can be used anywhere," says Le.

The EHF best predicted periods of greatest health service demand in Perth, with a consistent dose-response relationship: the higher the EHF, the higher the rate of ED and hospital presentations.

"We would suggest that state-based response plans consider using the EHF. Its national availability through the bureau, with its clear messaging of low, severe and extreme heatwaves, can be used to tailor different levels of response planning. Even low-intensity heatwaves in Perth have an impact on health demand, so the EHF allows us to prepare for these more-frequent events, as well as the occasional extreme ones."

## HEATWAVES ON HEALTHCARE: THE FORMULA FOR EARLY DIAGNOSIS

Story by Kitty Drok



## CHINA: IT'S NOT THE 'BE ALL AND END ALL' FOR AUSSIE TRADE

Story by Suzanna Wolz



**T**he Tiger, Tiger, Burning Bright? report examines issues that affect current trading patterns with Asia, opportunities for enhanced future trade and strengthened economic relationships with China, Japan and other countries in the Asia-Pacific and Indo-Pacific regions.

Director of Bankwest Curtin Economic Centre, Professor Alan Duncan, said international trade had a role to play in strengthening industrial sectors within the WA economy, including the mining and resources sectors but, critically, through greater diversification in the state's exports.

"The report reminds us that as important as China is to the economic fortunes of the state, it is by no means the state's only export destination," says Professor Duncan.

Together, the value of WA's exports to China and Japan amounted to some \$95 billion in 2013-14.

"China will remain a strong market for Western Australia's primary resources, as will Japan, as one of our traditional trading partners," says Professor Duncan.

"However, WA is extremely well-positioned to capitalise on new trading opportunities beyond China and Japan, both in terms of the scale and composition of its trade with Asian partners."

Alongside China and the traditional Japanese market as natural outlets for high-value commodity exports, there are emerging opportunities for Western Australia to service the demand among other Asian trading partners – Indonesia, Malaysia, Vietnam and India in particular.

Economic liberalisation across the Asian continent, with higher incomes among the rising middle class in Asia's emerging economies, has created a growing demand for prestige and luxury commodities – gold, high-quality manufactured goods, agriculture and food – as well as tourism and education exports.

"The state's trade and economic development strategies should certainly include a 'focus on quality' to capitalise on opportunities to sell to new markets for hi-tech or high-end products," says Professor Duncan.

"WA is well-positioned to capitalise on its reputation for high quality produce, and its comparative advantage in relation to time-zones and proximity to key trading partners in Asia."

The 72-page report also examines WA's trade and economic development from the perspective of WA's regions, and highlights important barriers that regional businesses and residents need to overcome in their pursuit of efficiency gains and growth.

Tiger, Tiger, Burning Bright? is the fifth report in the BCEC's 'Focus on Western Australia' series.

[business.curtin.edu.au/research/centres-institutions/bankwest-curtin-economics-centre](http://business.curtin.edu.au/research/centres-institutions/bankwest-curtin-economics-centre)

**A report released in September by the Bankwest Curtin Economics Centre has emphasised the need to diversify Western Australia's exports and widen our trading partnerships beyond China to maximise growth opportunities and strengthen WA's economy.**



# A NEW HIGH WATER MARK

**Due to its rapid urbanisation and vulnerability to climate-change impact, Bangladesh is a country in urgent need of science research that focuses on the relationships between people and environment.**

Story by Karen Green

**A**s a low-lying maritime country, Bangladesh is expected to be severely affected by the 2°C rise in average global temperatures forecasted for the coming decades. In fact, the World Bank has predicted the country will be a climate change hotspot – suffering more intense cyclones, rising sea levels and extreme floods. Not only will this impact food production and livelihoods, it is also likely to cause more frequent outbreaks of water-borne and vector diseases such as typhoid and dengue.

However, the immediate problem is the country's lack of flood-management strategies such as emergency shelters, particularly in the capital city of Dhaka. Now, Curtin researchers are working to help Bangladesh develop its capacity to address this.

At the Department of Spatial Sciences, Dr Ashraf Dewan and Dr Robert Corner recently supervised research by Curtin master degree student Akiko Masuya that focused on flood management in Dhaka.

Using geographic information systems (GIS) datasets that Dewan acquired at Dhaka University, the team developed flood hazard estimates from flood-frequency and floodwater depth maps. They then mapped the residential areas of Dhaka that were vulnerable to flooding and analysed spatial distribution of flood shelters in relation to flood hazards.

“The results showed that almost one-fifth cent of dwellings are in areas prone to flooding, yet the city has no disaster management plan,” Dewan says.

“We identified more than 5,000 buildings in Dhaka that could be used as emergency flood shelters, however more than half of these were not sufficiently close to vulnerable dwellings – which leaves almost half a million people unprotected during a flood emergency.”

The team is hoping their results will help Dhaka's urban planners and emergency managers to develop flood management and evacuation plans as a priority.

The research extends the focus of Corner and Dewan's 2014 book, *Dhaka Megacity:*

*Geospatial Perspectives on Urbanisation, Environment and Health.*

“Dhaka has become a sprawling megacity, and its rapid urbanisation is continuing, along with the likelihood of greater flood devastation in coming years,” Dewan explains.

“Bangladesh needs international support to meet the environmental and population health challenges that are resulting from rapid changes in land-use and land-cover; and urban growth and distribution.”

Interestingly, their expertise could also help inform flood management strategies in Australia.

“Australia will also be coping with more intense cyclones and flooding as a result of climate change,” Dewan says.

“And it's likely that, as the effects of global warming become more pronounced, multidisciplinary research using spatiotemporal data will inform the mitigation strategies of many countries.”

[spatial.curtin.edu.au](http://spatial.curtin.edu.au)

**A** recent study from Curtin University, in collaboration with researchers from Europe and North America, highlights the need to take underwater noise created by commercial and recreational ship traffic into consideration when planning marine spatial environments.

In a paper released by the Marine Pollution Bulletin, Director of the Centre for Marine Science and Technology Associate Professor Christine Erbe, says substantial potential exists for area-based management to reduce exposure of animals to chronic ocean noise.

“A core task in endangered species conservation is to identify important habitats and manage human activities to mitigate threats,” Associate Professor Erbe said.

“Many marine animals rely on acoustics for communication, reproduction, navigation, foraging and sensing their environment.”

The study introduces the concept of ‘opportunity sites’ – important habitats that experience low ship noise – and

suggests that measures are put in place to protect these sites in the future.

“Incorporating noise into spatial planning, such as for critical habitat designation or marine protected areas, may improve ecological integrity and promote ecological resilience to withstand additional stressors,” Associate Professor Erbe said.

Associate Professor Erbe and her colleagues suggest that ‘no-go’ zones for boats and fishing should be substantially larger than existing marine reserves allow. Sound travels very well and a long way under water – therefore a no-go zone for boats that is the same size as the area protected is not large enough when the acoustic parameters are taken into account.

By mapping ship traffic in British Columbia, Canada, the team modelled underwater noise from all vessels over the period of one year. They computed maps of ship noise, validated the map at 12 sites and then ‘filtered’ the ship noise with the hearing curves (audiograms) of the 11 marine mammal species (such as whales, seals and dolphins) which make British

Columbia their habitat, resulting in a noise map that was unique and meaningful to each species.

The study looked at areas where there is overlap – many animals and much noise – and areas where there is no overlap – many animals but no noise.

“The areas of overlap are ‘sites of risk’, where you might eventually see long-term impacts from shipping noise,” Associate Professor Erbe said.

“The areas without overlap are ‘sites of opportunity’ which should equally be included in marine spatial planning.

“Marine spatial planning often focuses on the risk sites, where things have already gone wrong and we try to implement measures to fix things and improve the disturbed or deteriorated environment.

“We don’t often take a step back and look at the opportunity sites, however as this study shows, it could prove well worth doing so for the future survival and success of many marine animal habitats.”

[cmst.curtin.edu.au](http://cmst.curtin.edu.au)

Research suggests marine mammals need noise-free zones

# QUIET UP THERE!

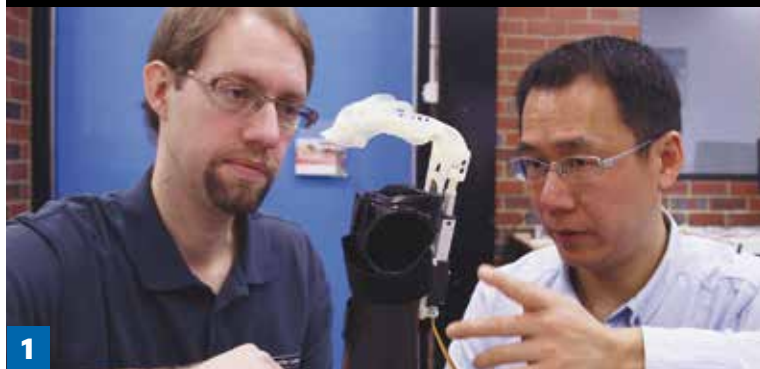
Story by Suzanna Wolz



# INNOVATIONS 2015

**The 2015 Commercial Innovation Awards attracted a record 46 applications from across Curtin University with 12 applicants shortlisted to present to a panel of judges who evaluated novelty, level of development, market potential and competitive advantage.**

**A 3D printable hand exoskeleton took out first place, netting its inventors \$15,000 and valuable commercialisation assistance.**



**2015  
AWARD  
WINNER**

## 1 ASSISTED FINGER ORTHOSIS

**A**fter surgery on a finger tendon, specialists use an orthosis to first immobilise the finger and then gradually introduce movement until normal function returns. Often these orthoses are complex, bulky devices that do not properly mimic the human finger.

PhD student Anthony Phan and his supervisor Dr Lei Cui from the Department of Mechanical Engineering at Curtin developed the Assisted Finger Orthosis, a robotic device that precisely controls a finger's range of movement during rehabilitation. With preprogramming, the orthosis can reduce the period of immobilisation, speeding up the healing process.

The orthosis can be customised using a scanner and 3D printer and can allow the addition of sensors for measuring grip and flexibility.



## 2 HYBRID DRONE

**C**urtin Engineering Outreach Mentors Jerry Tang and Jimmy Haranto, and engineering students Chester Gherbaz, Jake Bierman and Yew Meng Woo are developing BlackSwan: a next-generation unmanned aerial vehicle (UAV), or drone.

Spanning just one metre, the UAV will carry a load of up to six kilograms using powerful, electric-ducted fan engines. A unique, thrust-vectoring system will allow the BlackSwan to take off and land vertically, hover, and fly horizontally at more than 200 kilometres per hour.

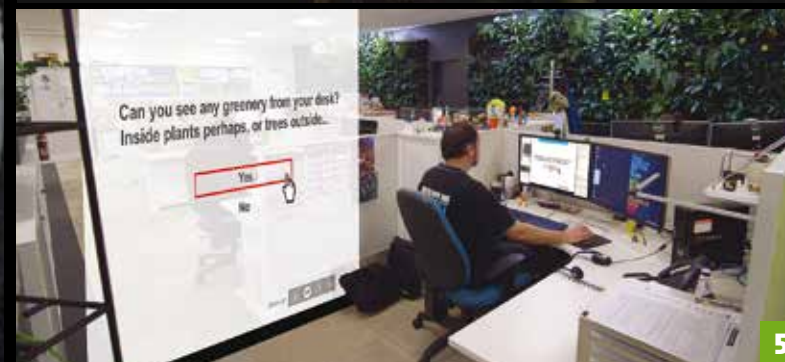
The multipurpose drone could be used for search and rescue operations, surveillance activities such as crop monitoring and shark spotting, or supply-delivery to otherwise inaccessible locations.

## 3 KNOWLEDGE UNLATCHED

**T**he cost of producing a limited print-run of scholarly books is more expensive than ever. Consequently, many libraries and readers are unable to access the results of important, government-funded research.

Curtin Honorary Doctorate Dr Francis Pinter has developed Knowledge Unlatched, a model for enabling open access to scholarly books, particularly in the humanities and social sciences. Libraries from around the world can now share the publishing costs of a title. In return, publishers make the book available for download on a creative commons licence.

Library participation in Knowledge Unlatched will help institutions secure savings, give readers free access to high-quality works, connect authors with audiences, and support the development of sustainable, open access platforms.



## 5 RATE MY SPACE

**A**poorly designed workspace can lower staff satisfaction and productivity. Dr Vanessa Rauland and Dr Samantha Hall from the Curtin University Sustainability Policy Institute have developed Rate My Space, a free online tool that rates the 'wellbeing' of a workspace and suggests improvements.

Users answer simple questions about the lighting, layout, thermal comfort, greenery and accessibility of their workspace. The tool ranks the space against a calculated benchmark and customises information and advice for enhancing the area.

Rate My Space aims to not only improve staff wellbeing, but also empower stakeholders to justify new buildings or upgrades and encourage staff and investors to choose healthier businesses.

### FOR MORE INFORMATION

On any of these innovations, contact Curtin University's Office of IP Commercialisation  
Tel: +61 9266 1778 Web: [curtin.edu.au/research/ip-commercialisation](http://curtin.edu.au/research/ip-commercialisation)

## 4 PROTEIN RECOVERY FROM WHEY

**E**very kilogram of cheese or yoghurt leaves producers with nine kilograms of whey, a commercially viable, nutrient-rich liquid. But extracting protein from excess whey is not affordable for most small- to medium-scale manufacturers.

Dr Tuna Dincer and Dr Corinne Vallet from the School of Public Health at Curtin have developed an inexpensive, one-step process that uses edible biopolymers to capture protein from whey.

The high-energy concentrate can be used in foods such as processed cheese, noodles and infant formula, as well as stockfeed for pigs and farmed fish, enabling Australian producers to turn some of the 300,000 tonnes of annual whey waste into revenue.



## 6 TOPDUMP MINE WASTE OPTIMISATION

**T**he removal of open pit mining waste can be a complex and costly process involving many waste sites and a large number of vehicles. Professor Erkan Topal from Curtin WA School of Mines has developed a set of algorithms that streamline the waste removal process.

TopDump software plans out the arrangement and nature of a mining operation's waste sites and produces scheduling to optimise its use of haulage vehicles. The program considers specific factors, such as separating marginal ore for potential later processing and preventing acid rock drainage to meet environmental regulations. TopDump can save companies up to 20 per cent on waste removal costs compared with conventional planning methods.



# Graduate Studies Overview 2015



**This has been another very busy and successful year for graduate studies at Curtin that has seen the opening of the Graduate Research School and transition to full operation. The school moved to its new location in Building 101 at the start of March 2015. Teams of graduate studies officers provide support for future and current students and academics, and provide advice on scholarships and theses. There is also a senior projects officer and training/events officer.**

Ensuring training opportunities for our students has been a major focus. The regular seminar and workshop series was again enhanced through the INSPIRE conference, that brings together higher degree by research (HDR) students from all five universities in Perth for a variety of skills training.

Curtin's "Pathways to your Future" program was well attended and provided insights into the post-study world. The working with industry theme was further enhanced by Curtin students' participation in IPREP – an innovative program matching small teams of students who are "under examination" with industry sponsors to have a real-life problem solving experience. As with INSPIRE, the program involves all five Perth universities working collaboratively for the benefit of our HDR students.

Part of the training focus this past year has been ensuring that our students understand the importance of researching with integrity. All students must now complete the online unit 'Research Integrity' prior to gaining candidacy.

In 2014, our HDR students contributed to more than 20 per cent of Curtin's research output and thus are an important part or the research effort. In addition, 300 students were approved to graduate.

Curtin continues to strive for excellence in research through the recruitment and training of HDR students and by providing a vibrant and collegiate environment in which all students can flourish.

**Professor Kate Wright**

Associate Deputy Vice-Chancellor Research Training

[curtin.edu.au/research/conduct-research](http://curtin.edu.au/research/conduct-research)

## Graduate profiles

### Don Boyd

National Centre for Student  
Equity in Higher Education  
Curtin Business School

Over the years, successive governments have developed policies to increase university participation among so-called equity groups, which include regional students, students with a disability, Indigenous students, and students from non-English speaking backgrounds. Progress has been made with some groups, but regional high school students are one group that still lags behind acceptable levels of university enrolment. Why? Don Boyd's doctoral research project aims to demystify the issue.

Boyd's research, within Curtin's National Centre for Student Equity in Higher Education, focuses on understanding what regional high school students understand about studying at university, with a view to helping them make more informed decisions about career choice and tertiary study.

He is working with data collected from Australian students from 15–16 years of age, who are making decisions regarding their subject selections for the final two years of secondary school and laying the foundations for their post-school destinations.

A key aspect of his research is to identify elements that shape student decision making, ways that schools can enhance that process, and importantly, how policy can be refined to address the issue.

Boyd says his motivation for doctoral research stems from a long career in school education, particularly his experience in regional locations. His other research interests include the attraction and retention of teachers to regional locations, improving student performance in rural and remote Australia and educational leadership in non-metropolitan locations.

[ncsehe.edu.au](http://ncsehe.edu.au)

### Adnan Mannan

School of Pharmacy  
Faculty of Health  
Sciences

Diabetes is a global burden with around 390 million sufferers worldwide, including 3.2 million Australians. Management can be difficult, with existing anti-diabetic medications being unsuitable for treating certain individuals in certain stages of the disease.

Adnan Mannan is researching the potential of a new treatment option: extract from the Mediterranean herb *Teucrium polium*. Shown to reduce blood glucose level, the plant extract may represent a powerful alternative to existing medications.

Mannan and his supervisors, Dr Rima Caccetta (School of Pharmacy) and Adjunct Professor Erik Helmerhorst (School of Biomedical Science), are observing the effect of the extract in various cells, to better understand its glucose lowering mechanism and to identify its anti-diabetic component.

In September, Mannan won the 2015 Curtin University final of the Three Minute Thesis challenge, edging out 10 other Curtin finalists, for the compelling presentation of his topic "The anti-diabetic potential of the herb *Teucrium polium*".

Mannan, originally from Bangladesh, says he set his sights on the competition on his first day at Curtin and relished the challenge of presenting in English, his second language.

"It was a challenge for me to compete with others whose English is better than mine in terms of fluency. But I learnt from this competition that confidence, way of explanation, style of speech and engaging people is much more important than anything else for a good presentation," Mannan says.

[curtin.edu/3mt](http://curtin.edu/3mt)

### Sarah Marley

Centre for Marine Science  
and Technology  
Faculty of Science  
and Engineering

The clamour of ships, oil and gas exploration and other human endeavours are adding a level of noise to the ocean that is potentially problematic for acoustically-specialised species such as dolphins.

Sarah Marley is researching the acoustic environment of coastal dolphins and investigating how they respond to an increasingly noisy ocean. The findings will help inform suitable management strategies to ensure a healthier marine environment.

As a child growing up on the Scottish coast, Marley would watch dolphins from shore, even recording their behaviour in her diary. This fascination inspired an undergraduate degree in zoology, a master degree in marine mammal science, and now, the beginnings of PhD in Applied Physics. Marley says her research is allowing her to explore the ocean in "the same manner as dolphins," using marine acoustics.

Her passion for the ocean is matched only by her passion for science communication. In 2014, the first year of her PhD, Marley was crowned the Trans-Tasman Three Minute Thesis Champion for the presentation of her thesis.

The annual competition gives research students from Australia and South-East Asia three minutes to deliver a compelling presentation on their thesis to a non-specialist audience.

"The competition gave me the opportunity to try my science communication skills against other outreach enthusiasts, and the chance to give people a whole new perspective on the ocean as a complex acoustic environment," Marley says.

Marley's research is supported by Curtin's Centre for Marine Science and Technology. The Holsworth Wildlife Research Endowment, Australian Acoustical Society and Swan River Trust have supported field components.

[cmst.curtin.edu.au](http://cmst.curtin.edu.au)



At the 2015 Premier’s Science Awards held in August, Thomas Russell, Curtin PhD Astronomy candidate, won the ExxonMobil Student Scientist of the Year. His success follows Curtin’s triumphs in 2014 with PhD Physics candidate Mark Zammit in the Student Scientist category, and mathematics researcher Dr Ryan Loxton in the Early Career Scientist category. Is Curtin cultivating Western Australia’s next generation of stellar scientists?

You studied undergraduate physics – what steered you to postgraduate astronomy?

Growing up in the country I was captivated by the night skies, and I was fascinated by the concept of black holes. During my undergrad I did an astrophysics unit and became interested in how black holes are able to extract and recycle energy from infalling matter.

It led me to the accretion team at the Curtin Institute of Radio Astronomy (CIRA), which had been recommended as very progressive with world-renowned researchers.

What made Curtin the right choice for your doctoral research?

CIRA is in the box seat for advances in radio astronomy. Curtin is one of the leading universities behind the Murchison Widefield Array (MWA). The success of the MWA, which is one of three precursor radio telescopes for the Square Kilometre Array, has proven that we can both build the technology and get great science from it.

So, one of the biggest science projects of the 21st century lured you to radio astronomy?

Not entirely, but it’s exciting to be working in a field with such amazing technology advances. The SKA will provide the next big step – it will have amazing coverage of the Universe and answer a lot of questions, although it will probably create many more questions. There’ll be a lot of ‘serendipitous science’ where we see something and have to work out what it is.

How does your research fit into this?

I study double-star systems consisting of a black hole in orbit with a ‘normal’ star, where the strong gravity of the black hole pulls matter from the star. But black holes don’t only swallow up this infalling material; some of the matter spirals into the black hole an accretion disc forms, and from the inner regions of the disc some of the material shoots back out as jets of plasma. Feedback effects from the jets can impact galaxy and galaxy cluster formation, as well as the distribution of matter in the Universe.

And what next – for you and for radio astronomy?

CIRA is very well connected and last year I was able to present my work internationally in the US, India, Europe and the UK. Right now I’m finishing my thesis, and then hopefully there’ll be more opportunities to travel and develop international linkages.

As for radio astronomy, the SKA will provide so many possibilities I couldn’t predict where radio astronomy is headed – but I’m looking forward to it.

astronomy.curtin.edu.au

Q+A

with DOCTOR  
THOMAS RUSSELL



INSTITUTES AND CENTRES

UNIVERSITY RESEARCH INSTITUTES

Australia–Asia-Pacific Institute
Curtin Health Innovation Research Institute – Biosciences
Curtin Institute for Computation
Curtin Institute of Radio Astronomy
Curtin University Sustainability Policy Institute
Fuels and Energy Technology Institute
International Institute of Agri-Food Security
Nanochemistry Research Institute
National Drug Research Institute
The Institute for Geoscience Research

UNIVERSITY RESEARCH CENTRES

Centre for Culture and Technology
Centre for Infrastructure Monitoring and Protection
Centre for Population Health Research
Centre for Research in Applied Economics
Centre for Smart Grid and Sustainable Power Systems
John Curtin Institute of Public Policy

EXTERNAL COLLABORATIVE RESEARCH CENTRES

Australasian Joint Research Centre for Building Information Modelling
Australia–China Joint Research Centre for Energy
Australia–China Joint Research Centre for Tectonics and Resources
Bankwest Curtin Economics Centre
Centre for Crop and Disease Management
Centre for Marine Science and Technology
Centre for Sport and Recreation Research
Cisco Internet of Everything Innovation Centre
Curtin Corrosion Engineering Industry Centre
Curtin Water Quality Research Centre
Curtin–Monash Accident Research Centre
National Centre for Student Equity in Higher Education
Sino–Australian Joint Research Centre for Ocean Engineering

CENTRES OF EXCELLENCE

ARC Centre of Excellence for All-sky Astrophysics
ARC Centre of Excellence for Core to Crust Fluid Systems
Centre of Excellence for Science, Seafood and Health

MULTI-INSTITUTIONAL RESEARCH CENTRES

Australian Housing and Urban Research Institute
Centre for Data Linkage
Centre for Exploration Targeting
Centre for Microscopy Characterisation and Analysis
CRC Mining
International Centre for Radio Astronomy Research
John de Laeter Centre
Pawsey Supercomputing Centre
Planning and Transport Research Centre
Sustainable Built Environment National Research Centre
Western Australian Biodiversity Science Institute
Western Australian Energy Research Alliance
Western Australian Marine Science Institute
Western Australian Satellite Technology and Applications Consortium

COOPERATIVE RESEARCH CENTRES

Antarctic Climate and Ecosystems Cooperative Research Centre
Australian Seafood CRC
CRC for Contamination Assessment and Remediation of the Environment
CRC for Greenhouse Gas Technologies
CRC for Infrastructure Engineering and Asset Management
CRC for Living with Autism
CRC for Remote Economic Participation
CRC for Spatial Information
CRC Mining
Deep Exploration Technologies CRC
Low Carbon Living CRC
Lowitja Institute
Wound Management Innovation CRC
Young and Well CRC

research.curtin.edu.au/about/institutes-centres



# R&D

# NOW

**curtin.edu.au/research**

*R&D Now* is published by Curtin University.

Material contained in *R&D Now* must not be reproduced in whole or in part or in any manner whatsoever without the written permission of the copyright holders and the editor.

All reasonable efforts have been made to trace copyright holders of material published.

The views expressed in *R&D Now* do not necessarily reflect those of Curtin University. This material does not purport to constitute professional or legal advice. Curtin accepts no responsibility for and makes no representations whether express or implied as to the accuracy or reliability in any respect of any material in this publication. Except to the extent mandated otherwise by legislation, Curtin University does not accept responsibility for the consequences of any reliance which may be placed on this material by any person. Curtin will not be liable to you or to any other person for any loss or damage (including direct, consequential or economic loss or damage) however caused and whether by negligence or otherwise which may result directly or indirectly from the use of this publication.

*R&D Now* is available in PDF at [news.curtin.edu.au/publications](http://news.curtin.edu.au/publications) and in alternative formats on request. For more information contact the Editor on +61 8 9266 1598.

ISSN 1446-1234

© Curtin University 2014  
CRICOS Provider Code 00301J

Curtin University is a trademark of  
Curtin University of Technology

Design: M3 Design Co.  
Photography: James Rogers

**Editorial Team**

Editor: Jarrad Long  
Sub Editor: Anita Shore  
Writers: Karen Green and Kitty Drok

Office of Research  
Curtin University  
Kent Street Bentley WA 6102  
GPO Box U1987 Perth WA 6845  
Tel: +61 8 9266 7863  
Fax: +61 8 9266 3793  
[curtin.edu.au/research](http://curtin.edu.au/research)

